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Crowdfunding 2.0: the next-generation philanthropy

A new approach for philanthropists and citizens to co-fund disruptive innovation in global health

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"He who has once tasted critique will for ever loathe all the dogmatic twaddle with which he was hitherto contented. . . ."
Immanuel Kant [1]

The past is not always a guide to the future, especially when it comes to disruptive innovation; groundbreaking ideas or products that seem to appear out of the blue can lead to new technologies or overturn markets, sometimes in short order. The automobile, semiconductor electronics and the Internet are examples of innovations that revolutionized economies and societies. But disruptive innovation is easier said than done. Many enthusiastic claims about "the next big thing" quickly turn out to be exaggerated once the innovation in question faces the test of reality and the context of real-life application. True disruptive innovation is a combination of vision, serendipity, knowledge and a willingness to think "horizontally" about multiple future outcomes and applications—which is why it is so exceedingly rare.

There is a lamentable dearth of innovation in global health research, for example, on non-communicable diseases (NCDs), such as cancer, which is a scourge in both developing and developed countries. Overall funding levels to find new diagnostics and therapeutics for many NCDs have increased steadily, but disruptive innovation has remained markedly below expectations. When more research money does not lead to commensurate results, one suspects that something is awry with the way how we do science. This question—how to fund research—is just as important as what research to fund but it is often the latter which defines the projects and questions in traditional laboratory science.

Before asking for even more funds for research and development (R&D), we therefore should reflect whether the prevalent funding system for biomedical R&D is the most efficient method to cultivate disruptive innovation and whether there are possible alternatives. It seems that the linear model of biomedical R&D—basic research, translational research, proof of concept, product development—does not efficiently work in health research, particularly in the developing world. Disruptive innovation, by definition, does not follow these incremental steps, but instead depends on creative leaps often without sufficient data and time to develop a fully fledged proof of concept study. It is the grand challenge for both academics and industrialists: how do we cultivate a research ecosystem that enables and encourages disruptive innovation? New concepts such as social innovation, for example, co-design of innovations and research projects by scientists and citizens also deserve attention in this context [2,3].

Neither academic nor industry-driven research can be blamed for their preoccupation with proof of concept or subscription to a linear model of innovation. Both are subject to social, economic and political forces within the existing research system. As a consequence, health research is often risk averse and seeks short-term returns on investments [4,5]. It also bears the potential for "centrism" [6] in academic and expert circles where technology network or science consortia members might review and support each others' applications. Not surprisingly, many academics have adopted a strategy of "extensive pilot data collection": nearly completing a project before they submit a grant proposal to finance it. Incremental advances are seen as a safe strategy to get funded, which comes at the expense of out-of-the box ideas with potential for creative leaps. The result is that out of nearly US$160 billion spent annually on biomedical research, up to 85% of this funded research is estimated to be inefficient [5]. The main reason for this waste is "finding the right answers for the wrong questions": research findings that have little or no relevance for the communities who are meant to benefit [5,7].

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Biotechnology entrepreneurs seeking seed funding from venture capital (VC) face the same predicaments as academics applying for government funding. VC agencies can have overly zealous diligence processes that stifle creativity and innovation

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(http://avc.com/2013/05/you-can-do-too-much-due-diligence/). This is not surprising, as these agencies spend investors' money to secure their return on investments and are understandably often risk averse.

Supporting disruptive innovation is even harder in the developing world. Many impoverished countries, which are often plagued by poverty, violence, human rights violations or unstable economic or political structures, are able to create dynamic innovation climates, but they are often fragile. These rapidly fluctuating and fragile social dynamics do not provide sufficient stability for proof of concept-driven linear innovation.

There are two funding schemes that can support innovative high-risk ideas at an early stage of development, frequently without hard data or proof of concept to back up the idea: so-called angel investors or philanthropists, and crowdfunding. Angel investors are often former VC entrepreneurs who know all too well the importance of disruptive innovation and out-of-the-box creative thinking. Importantly, and distinct from governments or VC funders, many (if not all) angel investors pursue noble causes and not merely a high return on investment.

Crowdfunding, which has emerged as a revolutionary and promising approach to fund research outside established public and private funding schemes, is also more concerned with doing some good or supporting out-of-the-box ideas outside the boundaries of traditional disciplines. According to the latest analysis, crowdfunding platforms raised US$2.7 billion in 2012, with more than one million campaigns globally—although not all platforms support research—and this further increased to US$5.1 billion in 2013 [8].

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The global NCD epidemic is a worthy challenge for both philanthropists and citizens. Their involvement would create a disruptive innovation ecosystem. For private citizens, this would represent an opportunity to directly address problems that affect their communities, while philanthropists would be able to put their money toward driving relevant and robust innovation and could even expect to see some return on their investment by efficient R&D. Creating the capacity for such a global scientific effort is, however, well beyond the reach of any individual philanthropist or crowdfunding project. What is needed is a concerted effort that brings together angel investors and citizens to pool their resources.

Philanthropists have national associations; for example, the Angel Capital Association in the USA (http://www.angelcapitalassociation.org/) or the British Business Angels Association in the UK (http://www.ukbusinessangelsassociation.org.uk). These are loose networks, but they have the potential to scale up among investors. Together with crowdfunding, they could raise substantial money and get a return on their investments, too.

Both the number of contributors and the size of their individual contributions determine the overall crowdfunding. By way of example, India has a population of 1.3 billion, many of whom donate to charitable causes. If each citizen were to donate only a single Rupee (1.6 cent), it would amount to US$21.2 million. Crowdfunding therefore has the potential to harness economies of scale of massive populations in regions such as India or China to support locally meaningful research. Oral cancers, for example, greatly impact the Indian population owing to widespread tobacco chewing. Local citizens and angel investors could co-fund projects to address the problem. The Middle-East faces a huge challenge of refugees from Syria and Iraq, as well as migrants, all of whom are in dire need of health care; innovative approaches could help to deliver health services to displaced populations (www.hurriyetdailynews.com/working-with-syrian-doctors-in-diaspora.aspx?pageID=449&nID=75621&NewsCatID=396).

We are at an inflection point in the funding of social innovation in the 21st century knowledge society. We now have the opportunity to create the next generation of crowdfunding to bring together philanthropists and local citizens. Doing so will generate a nuanced understanding of the local social context in which research is conducted—a key ingredient for disruptive innovation—and should raise substantial capital with economies of scale particularly in the developing world. It might also reduce wasteful research. Of equal importance is that such a hybrid constituency of funders and citizens would cater to the personal ethos of angel investors and should keep the "blue skies" bio-entrepreneurial spirit alive. The heterogeneity of funders, scientists and citizen communities might also enable such epistemically diverse groups to identify barriers to a disruptive innovation ecosystem.

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Both philanthropists and private firms are beginning to realize that citizens can contribute innovative research ideas owing to their familiarity with the local context, or funders' or scientists' lack of familiarity with the assumptions and history of a given research field. The international Bioquest 2013 Biotechnology Conference in India has featured the PITCHFEST competition, for example, which connects biotechnology graduate students at Amrita University in Kerala with funders and rural communities. General Electric has offered a reward to anyone in the world who can come up with a design for a low-weight aircraft engine using 3-D printing; indeed, numerous out-of-the-box ideas for disruptive innovation came from persons outside the aviation industry.

Crowdfunded projects also try to engage stakeholder communities to generate disruptive innovation. The major benefit of next-generation crowdfunding or crowdfunding 2.0 is the opportunity to learn from each other and calibrate interests and expectations among diverse epistemic constituencies: local communities, investors, engineers, scientists or citizens who want to contribute to social innovation. In the same way as global health needs are heterogeneous and universal, so will be crowdfunding 2.0 for biotechnology and disruptive innovation (Table 1).

However, crowdfunding 2.0 is not the panacea for all problems in contemporary science; in fact, there are a

Table 1. Comparison of major funding schemes for disruptive "blue skies" innovation.

	Public	Private		Public – Private
	Government	Venture capital	Angel investors	crowdfunding 2.0
Amount funded	A wide range from several thousands to millions	Usually provide larger funds than angel investors	Usually up to $100,000; sometimes up to $1,000,000 (super angels)	A wide range of funding is possible
Rapid funding	+	+	+++	+++
Requirement to show linear proof of concept	+++	+++	+ / No	No
Risk-seeking; embracing uncertainty	+	+ / No	++	+++
User & "social innovation" orientation	+	+ / No	++	+++
"Extended peer review" beyond technical experts	+ / No	No	+ / No	+++
Opportunity to fund junior investigators, citizen scientists with no publication record, or infrastructure projects	+	+ / No	+	+++
Project leadership	Single or few PIs	Single PI usually	Single PI usually	Collective leadership
Ethics framework	Institutional	Institutional	Institutional	Institutional or oversight for participant-led research (PLR) and citizen science
Overall potential for disruptive innovation	+	+	++	+++

+, Low; **++**, Moderate; **+++**, High.

number of caveats and risks involved in funding research outside the established review and funding system. For instance, traditional grants in biomedical research come with strict guidelines and regulations for human subject research, for research using animals and for biosafety. There are also strict sanctions to punish and discourage fraud and falsification. Crowdfunding 2.0, despite its focus on blue skies research, innovation and extended review by citizens, should not become an alternative *laissez faire* scheme to circumvent established checks and balances.

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To gain and maintain public acceptance—and therefore public support—crowdfunding 2.0 has to find ways to establish and enforce ethical rules and regulations. In 2011, Nature Biotechnology published a study on the effects of lithium on the progression of amyotrophic lateral sclerosis (ALS) [9], which relied on online patient communities. The authors analyzed self-reported data by ALS patients who experimented with lithium carbonate treatment, and the findings were confirmed in subsequent clinical trials. Effy Vayena and John Tasioulas, commenting on such participant-led research (PLR), wrote that "[r]esearchers may be motivated not only by the goal of advancing medical knowledge, but also by profit-making, career advancement, impacting policy, etc. This can create incentives to infringe ethical requirements applying to research, including those governing risk of harm and non-exploitation. Yet, PLR is hardly free of incentives to engage in unethical behavior. For example, some PLR takes place within a profit-making structure. And there are also potentially distinctive incentive issues within PLR. Given that those conducting the research often hope to benefit personally from its outcome (e.g., in experimenting with an off-label use of a medication), they may be led to engage in unacceptable forms of risk-taking, and to pressurizing others to follow suit" [10].

Indeed, crowdfunding would also need to establish sound ethics oversight. One possible solution would be to use the existing regulatory and oversight framework at research institutions that are funded by it. Scientific and technical experts, too, can join anywhere along the crowdfunding 2.0 scheme, particularly during the implementation phase (Fig 1), which would tie in traditional institutional ethics oversight. However, unlike the traditional scientist-led research where citizens may or may not be invited as legitimate partners, crowdfunding 2.0 is more likely to empower research participants as citizens hold the purse strings and become the parties who invite the scientists to take part in their research, rather than vice versa.

In cases when philanthropists and citizens choose to implement their crowdfunded project without classical institutional or scientists' oversight, we refer the reader to the works of Vayena & Tasioulas for ethics oversight on PLR [10]. They identified "six areas that are of potential relevance to ethical oversight: institutionalization, state recognition and support, incentive structures, openness, bottom-up approach, and self-experimentation" [10]. Taken together, the emerging PLR ecologies demand ethical oversight that recognizes the character of such research. It should also strike a proper balance between protectionist ethics and

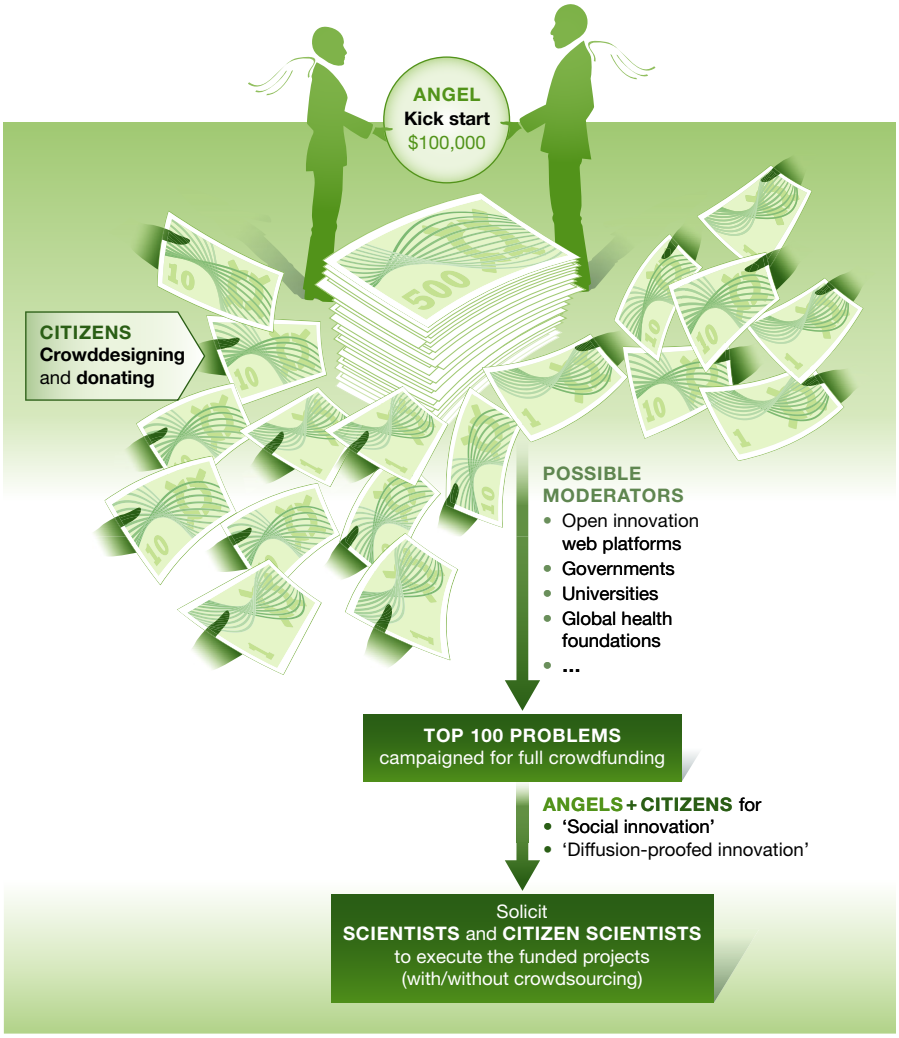

Figure 1. Crowdfunding 2.0 integrated with crowddesign and crowdsourcing.
The funding amounts noted are examples that we think are reasonable and scalable to bring together angel investors and local citizens.

enabling the anticipated benefits of crowdfunding 2.0.

In the field of innovation governance, first-order action has second-order consequences. There might be a risk therefore that crowdfunding 2.0 by citizens and angel investors could lead to reduced government spending on research, as policymakers could be tempted to cut science budgets. Clearly, crowdfunding 2.0 is not and cannot be a substitute for traditional research funding through governments, and it is likely that governments already understand the need for "innovating upstream" at the level of research funding. First, even a massive increase in philanthropic and citizen spending via crowdfunding 2.0 for research would still pale in comparison to the research budgets of advanced nations. Second, crowdfunding 2.0 for global health research, by its very nature, would focus on select priority areas where disruptive innovations have lagged behind and on social innovation projects with an impact on people's health. Disruptive innovation stands on the shoulders of previous knowledge to develop new products and services; more direct public–private funding engaged with citizen science and real-life innovation contexts as in crowdfunding 2.0 is therefore not an argument to cut funding for science and innovation (Table 1).

Another unresolved issue is credit attribution for PLR and citizen science associated with crowdfunding 2.0. A possible solution could be a cloud computing-based platform for researchers, funders and contributors that citizens and investors from across the globe can access remotely to record ideas, funding and other contributions. Such a transparent, traceable and auditable system would create a true "innovation commons" where participants can co-design experiments, discuss the project trajectory and steer it toward robust and sustainable innovation.

Disruptive innovation, blue skies research and interdisciplinary collaboration are major buzzwords in R&D these days, but the reality is different [4]. In candid conversations, most scientists lament that the "one lab/one PI" hyper-competitive model of the life sciences only pays lip service to interdisciplinarity, innovative ideas, collegiality and mutual trust; unlike in physics or astronomy, which have long adopted collective ways of

working together. Could the crowdfunding model of paying for and co-designing research contribute fresh and innovative solutions to entrenched societal and global health problems where the established biomedical research system has failed so far?

The idea of raising small amounts of money from a large number of people via the Internet is not new. Artists, musicians and the film sector have been "crowding" for years. But these earlier practices have targeted an undifferentiated mass of potential contributors. The crowdfunding 2.0 social innovation scheme proposed here (Fig 1) is semi-structured to bring together both citizens and angel investors while leaving ample space for citizen and community participation at the upstream *design* and *funding* stage. One conceivable way forward for online platforms to implement crowdfunding 2.0 globally could be an independent nested governance system [3], whereby each stakeholder community (angels, citizens, scientists and so on) cross-checks each others' behavior and accountability. Moreover, as people are more likely to donate to projects where they are also idea contributors, one could anticipate that crowdfunding 2.0 will involve extensive participation from user communities (Fig 1). This would cultivate "diffusion proof" innovations: users early on vet scientific design and R&D priorities, rather than resorting to traditional marketing to implement innovations created in the presence of unabridged chasms between upstream (designers/funders) and downstream (users/citizens) actors. Unlike the traditional public–private funding streams, crowdfunding 2.0 has the potential to truly empower citizens and achieve extended peer review for creative leaps that directly benefit user communities.

Immanuel Kant aptly observed the importance of independent critique for being a scholar [1]. But are we ready for a sea change in how we design, fund and execute science and innovation in early 21st century? Fundamental opinions about science and society are like bones: they are shaped in youth and fully formed when we enter graduate school. Graduate students, high school students and independent scholars who are prepared to rethink unchecked assumptions about research funding, scientific design and innovation might well consider crowdfunding 2.0. It seems that such a rethink is timely after some 400 years of post-Renaissance science.

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Conflict of interest

The authors declare that they have no conflict of interest.

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